# Final Report on Grant NAS5-97140

(POLAR/CEPPAD Data Analysis)

Background

D.N. Baker is a co-investigator on the Comprehensive Energetic Particle Pitch Angle Distribution (CEPPAD) experiment of POLAR. Dr. Baker has been active in the design and calibration of the CEPPAD sensors and is now heavily involved in the analysis and interpretation of the data. Baker and his team have developed analysis and data display software and continue to support all aspects of the CEPPAD program.

Recent Efforts

Dr. Baker has a team of research associates, graduate students, undergraduate students, and visiting scientists who are involved in analysis of CEPPAD data. This work has led to numerous published papers and scores of invited and contributed talks at scientific meetings (see attachments). The work has focussed very substantially on high-energy electron results, however new emphasis was placed on storm-substorm relationships and on ion measurements as well. By using multi-spacecraft techniques, the CEPPAD data have provided extensive new insights into how particles are accelerated, transported, and lost within the Earth's magnetosphere. Substantial new understanding of magnetospheric processes and particle acceleration has been obtained in the approach to the solar activity maximum period.

Report on specific activities:

D. N. Baker and his team of Research Associates, postdoctoral fellows, graduate students, undergraduate students, and scientific visitors supported the CEPPAD investigation in four key areas. These were:

1. Dr. Baker and his team performed data reduction and scientific analysis. This work was used to present results at national and international scientific meetings and was also used as a basis for scientific journal publications. The team also performed correlative analysis in support of "space weather" events and satellite anomaly resolution.

2. The CU/LASP team supported ISTP science team meetings and worked with Project Office personnel to communicate POLAR/GGS results to NASA management, educational organizations, and the general public.

3. Dr. Baker and his group developed and distributed data analysis and display tools and shared software with other CEPPAD, GGS, and ISTP colleagues.

4. The CU/LASP team supported ongoing calibration and operational evaluations of the CEPPAD sensor suite with particular emphasis on cross-comparisons with other POLAR and ISTP sensors.

Attachment: Publication, Contributed Talks, Invited presentations

## POLAR/CEPPAD References

## PUBLICATIONS


1996

Baker, D.N., J.H. Allen, R.D. Belian, J.B. Blake, S.G. Kanekal, B. Klecker, R.P. Lepping, X. Li, R.A. Mewaldt, K. Ogilvie, T. Onsager, G.D. Reeves, G. Rostoker, R.B. Sheldon, H.J. Singer, H.E. Spence, and N. Turner, An assessment of space environmental conditions during the recent Anik E1 spacecraft operational failure, ISTP Newsletter, 6, No. 2, p. 8, 1996.

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1996

Baker, D.N., Recent High-Energy Electron Measurements in the Earth's Magnetosphere, Laboratory for Extraterrestrial Physics, Seminar Series, NASA/Goddard Space Flight Center, Greenbelt, MD 29 March 1996.

Baker, D.N., Geomagnetic storms: Ring current and Radiation Belt Processes, GEM Space Weather Tutorial, GEM Summer Workshop, Snowmass, CO, 26 June 1996.

Carovillano, R.L., and D.N. Baker, The IASTP and solar-terrestrial physics, 31st COSPAR Scientific Assembly, Birmingham, UK, 14-21 July 1996.

Baker, D.N., What is space weather? 31st COSPAR Scientific Assembly, Birmingham, UK, 14-21 July 1996.

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Baker, D.N., Space Weather, Center for Integrated Plasma Studies Seminar Series, University of Colorado, Boulder, CO, 21 February, 1997.

Baker, D.N., Smaller, Faster, Cheaper, Better – Which one do you want?, Space Science Institute, Education Workshop, Boulder, CO, 25 February 1997.

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Wilken, B., D.N. Baker, T. Doke, N. Hasebe, T. Mukai, T. Yamamoto, G. Reeves, and S. Ullaland, Geoactivity in response to CIR/CME events: A synoptic view, EGS, Vienna, Austria, April 1997.

Baker, D.N., Earth's Radiation Belts: Structure and Electron Acceleration, Geospace Environment Modeling (GEM) Summer Workshop, Tutorial Lecture, Snowmass, CO, 20 June 1997.

Baker, D.N., The IACG campaigns, Invited lecture, International Symposium on Solar-Terrestrial Coupling Processes, Paros, Greece, 23-27 June 1997.

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Baker, D.N., Relativistic particle acceleration in the Earth's magnetosphere, Joint European and National Astronomical Meeting, (JENAM-97), 6th European and 3rd Hellenic Astronomical Conference, Thessaloniki, Greece, 2-5 July, 1997.

Baker, D.N., Space Weather Effects on Satellites, Invited lecture, International Space University Summer School, Rice University, Houston, TX, 18 July 1997.

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Baker, D.N., The use of indices in spacecraft observational studies and future requirements, IAGA 97, Uppsala, Sweden, August 13, 1997.

Baker, D.N., CME-related magnetic clouds and relativistic magnetospheric electron acceleration, Invited talk, 31st ESLAB Symposium: Correlated Phenomena at the Sun, in the Heliosphere, and in Geospace, ESTEC Conference Center, Noordwijk, The Netherlands, 24 September 1997.

Baker, D.N., Particle linkages to the middle atmosphere, Laboratory for Atmospheric and Space Physics Seminar, Boulder, CO, 30 October 1997.

Baker, D.N., The Third IACG Campaign, AGU, Fall Meeting, San Francisco, CA, 8 December 1997.

Reeves, G.D., et al., Relativistic electron flux variations: A new, global, ISTP perspective, AGU Fall Meeting, San Francisco, CA, 8-12 December, 1997.

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Spence, H.E., A.M. Jorgensen, T.A. Fritz, R.B. Sheldon, M.G. Henderson, G.D. Reeves, J.B. Blake, J.F. Fennell, and D.N. Baker, Imaging the Substorm Injection using Global ENA Images and Simultaneous Multipoint Observations, Toward Solar Max 2000: The Present Achievements and Future Opportunities of ISTP and GEM, Yosemite National Park, California, 10-13 February.

Baker, D.N., Solar disturbances and geospace consequences: More results from campaign 3, AGU, Spring Meeting, Boston, MA, 29 May 1998.

Baker, D.N., Acceleration of highly relativistic electrons in Earth's outer radiation belts, 1998 Cambridge Symposium-Workshop-Multi-scale Phenomena in Space Plasmas, Cascais, Portugal, 1 July 1998.

Baker, D.N., Radiation belt models and forecasts, Western Pacific Geophysics Meeting, Taipei, Taiwan, 21-24 July, 1998.

Baker, D.N., S.G. Kanekal, J.B. Blake, B. Klecker, and R.A. Mewaldt, On the global coherence of outer zone relativistic electron behavior, Western Pacific Geophysics Meeting, Taipei, Taiwan, 21-24 July, 1998.

Baker, D.N., Space Weather effects on spacecraft, International Space University, Cleveland State University, Cleveland, OH, 30 July, 1998.

Baker, D.N., A Low cost Mercury Orbiter Mission, popular talk, Pachyderm Club, Pueblo, CO, 4 September, 1998.

Baker, D.N., Complexity, Self-Organization, and Non-linear Dynamics in Space Plasmas, AGU, Fall Meeting, San Francisco, CA, Dec. 6-10, 1998.

Baker, D.N., Solar Minimum and Solar Maximum: Differences in Atmospheric, Ionospheric, and Inner Magnetospheric Properties, AGU, Fall Meeting, San Francisco, CA, Dec. 6-10, 1998.

Baker, D.N., Collective Phenomena in the Inner Magnetosphere, AGU, Fall Meeting, San Francisco, CA, Dec. 6-10, 1998.

Baker, D.N., The Value and Deficiencies of Indices and Parameterizations in Geospace Modeling, AGU, Fall Meeting, San Francisco, CA, Dec. 6-10, 1998.

1999

Baker, D.N., The Earth's radiation belts and the IMEX mission, Guest lecture, Aerospace Engineering Department, University of Colorado, (Boulder), 2 February 1999.

Baker, D.N., Advanced technology from the university perspective, NASA Space Technology Management Operations Working Group Meeting, Los Angeles, CA, 9 February 1999.

Baker, D.N., IMEX: A new look at the Earth's Van Allen radiation belts, K.D. Woods Memorial Lecture Series, University of Colorado College of Engineering, 17 February 1999.

Baker, D.N., New views of magnetospheric substorms, LASP Seminar Series, University of Colorado, Boulder, CO, 18 March 1999.

Baker, D.N., and C.A. Barth, New results from SNOE and ISTP spacecraft, NASA Headquarters Seminar, Washington, DC, 6 April 1999.

Baker, D.N., Energetic particle properties in the inner magnetosphere through the 11-year solar cycle, Spring AGU meeting, Boston, MA, May 31-June 4, 1999.

Baker, D.N., Sun-Earth Connections: How is the weather in Space? Invited lecture, Graduate Student Summer Program Lecture Series, NASA/Goddard Space Flight Center, Greenbelt, MD, 11 June 1999.

Baker, D.N., Present status of radiation belt research, CEDAR-GEM-SHINE Program on Solar-Terrestrial Coupling Processes, University of Colorado, Boulder, 18 June 1999.

Baker, D.N., Tutorial Lecture of Relativistic Electrons, SHINE-GEM Symposium, Space Environment Center, NOAA, Boulder, CO, 19 June 1999.

Baker, D.N., The S-RAMP Program and Space Science Research, Invited presentation, SCOSTEP Bureau Meeting, Coseners House, Abingdon, UK, 16 July 1999.

Baker, D.N., Energetics and topology of the magnetosphere during geomagnetic storms, IUGG99, Birmingham, England, 18-30 July 1999.

Baker, D.N., STEP – Results, Analysis, and Modeling Phase, SCOSTEP, Conference of Delegates, IUGG Meeting, Birmingham, UK.

Baker, D.N., Sun-Earth Connections: How is the weather in Space? Invited presentation, Pachyderm Club of Pueblo, Pueblo, CO, 3 September 1999.

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